Thanks for purchasing our Electronic Speed Controller (ESC). High power system for RC model can be very dangerous, so please read this manual carefully. In that we have no control over the correct use, installation, application, or maintenance of our products, no liability shall be assumed nor accepted for any damages, losses or costs resulting from the use of the product. Any claims arising from the operating, failure or malfunctioning etc. will be denied. We assume no liability for personal injury, property damage or consequential damages resulting from our product or our workmanship. As far as is legally permitted, the obligation to compensation is limited to the invoice amount of the affected product.

【Features】

- ► High performance microprocessor brings out the best compatibility with all kinds of motors and the highest driving efficiency.
- ► Maximum motor speed: 210000 RPM (2 poles), 70000 RPM (6 poles), 35000 RPM (12 poles).
- ► 3 start modes: Normal / Soft / Very-Soft, compatible with fixed-wing aircraft and helicopter.
- ► Throttle range can be configured to be compatible with all transmitters currently available on market.
- ► Smooth, linear, quick and precise throttle response.
- ► Separate voltage regulator IC for microprocessor to get a better anti-jamming capability.
- ► Multiple protection features: Low-voltage cut-off protection / over-heat protection / throttle signal loss protection.
- ► The output of the built-in BEC is switchable by user programming (5.25V or 6.0V).
- ► With governor mode for helicopter.
- ► USB supported. The firmware of the ESC can be updated by the USB adapter.
- ► Several kinds of **Program Cards** are supported. Very easy to program the ESC at home or at the field.

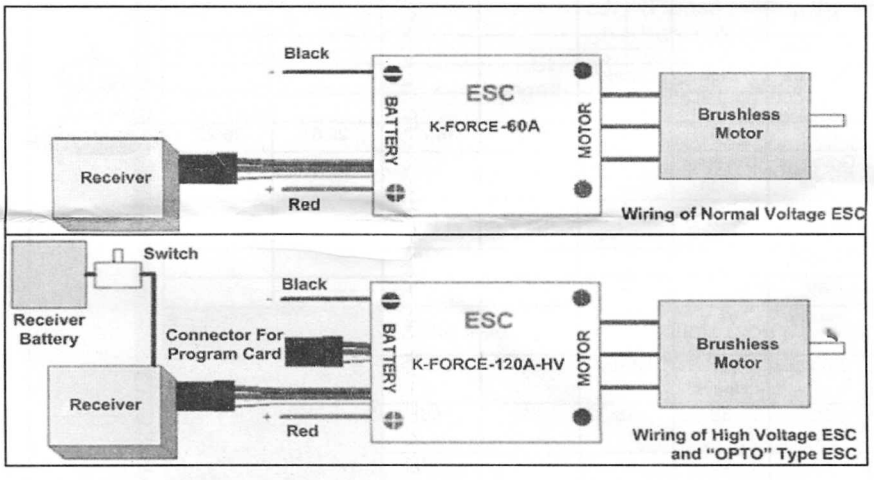
【Specifications】

TURNIGY K-FORCE Series										
Normal Voltage ESC（Supports 2 to 6 Cells Lipo）										
Class	Model	Cont. Current	Burst Current	BEC Mode	BEC Output	User Programmable	Battery Cells Lipo	Battery Cells NiMH	Weight	Size L*W*H
40A	K-FORCE-40A	40A	60A	Switch	5.25V or 6V, 3A	Yes	2-6	5-18	38g	59*27*12
60A	K-FORCE-60A	60A	90A	Switch	5.25V or 6V, 3A	Yes	2-6	5-18	68g	70*34*16
80A	K-FORCE-80A	80A	120A	Swicth	5.25V or 6V, 3A	Yes	2-6	5-18	77g	70*34*16
100A	K-FORCE-100A	100A	150A	Switch	5.25V or 6V, 3A	Yes	2-6	5-18	82g	70*34*16
150A	K-FORCE-150A-OPTO	150A	220A	None	None	Yes	2-6	5-18	125g	88*55*15
High Voltage ESC（Supports 5 to 12 Cells Lipo）										
70A	K-FORCE-70A-HV	70A	105A	None	None	Yes	5-12	15-36	82g	70*34*16
120A	K-FORCE-120A-HV	120A	180A	None	None	Yes	5-12	15-36	125g	88*55*15

Note1: *BEC means the "Battery Elimination Circuit". It is a DC-DC voltage regulator to supply the receiver and other equipments from the main battery pack. With the build-in BEC of an ESC, the receiver needn't to be supplied with an additional battery pack.*

Note2: *The ESC named "xxx-OPTO" or "xxx-HV" hasn't a built-in BEC, an UBEC (Ultimate-BEC) or an individual battery pack should be used to power the receiver. And an individual battery pack is needed to power the program card when setting the programmable values of such ESCs, please read the user manual of program card for reference.*

【Wiring Diagram】



【Programmable Items】

1. **Brake Setting:** *Off / Soft / Hard / Very Hard, default is "Off".
2. **Battery Type:** *Lithium (Lipo or Li-ion) / NiMH, default is "Lithium".
3. **Low Voltage Protection Mode (CutOff Mode):** *Soft Cut (Gradually reduce the output power) / Hard Cut (Immediately stop the output power). Default is "Soft Cut".
4. **Low Voltage Protection Threshold (Cutoff Threshold):** Low / *Middle / High / Custom, default is "Middle".
   1) For lithium batteries, the cutoff threshold of the whole battery pack is calculated according to the cells number.
      For normal voltage ESC (supports 2-6 cells Lipo), the Low / Middle / High value for each cell is: 2.85V / 3.15V / 3.30V
      For high voltage ESC (supports 5-12 cells Lipo), the Low / Middle / High value for each cell is: 2.75V / 3.0V / 3.25V
      For example, if the cutoff threshold is set to "Middle", then the threshold for a 3 cells Lipo battery pack is 3.15*3=9.45V.

   2) For NiMH and NiCd batteries, the cutoff threshold of the whole battery pack is calculated as follows:
      Low : 50% of the battery's battery's full charged voltage
      Middle: 62.5% of the battery's full charged voltage

High: 75% of the battery's full charged voltage

3) If this programmable item is set to "Custom", that means you can set the cutoff threshold for the whole battery pack very accurately with the step of ±0.1V. The LCD program box or PC software (through USB adapter) is needed to customize the value.

5. **Start Mode：** *Normal / Soft / Very-Soft, default is "Normal".

"Normal" is preferred for fixed-wing aircraft. "Soft" or "Very-Soft" are preferred for helicopters. The initial acceleration of the "Soft" and "Very-Soft" modes are slower than "Normal" mode, usually it takes 3 second for "Soft" mode or 8 seconds for "Very-Soft" mode from 0% throttle advance to full throttle. After startup, if the throttle is closed (throttle stick is moved to the bottom position) and opened again (throttle stick is moved upwards) within 3 seconds, the restart will be temporarily changed to "Normal" mode to get rid of the chances of a crash caused by slow throttle response. This special design is usedful for aerobatic flight.

6. **Timing：** 0°/ 3.75° / 7.5° / 11.25° / *15° / 18.75° / 22.5° / 26.25°, default is 15°. ***Note3***

Usually, low timing value is suitable for most motors. But there are many differences among structures and parameters of different motors so please try and select the most suitable timing value according to the motor you are just using. The correct timing value makes the motor run smoothly. And generally, higher timing value brings out higher output power and higher speed.

Note3: *After changing the timing setting, please test your RC model on ground prior to flight!*

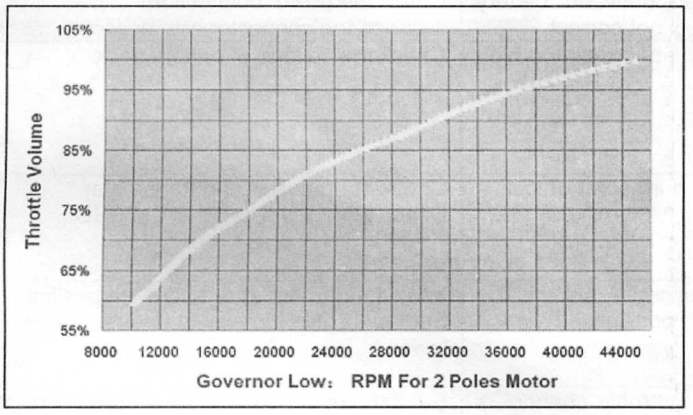
7. **Governor Mode：** *Off / Governor Low / Governor High, default is "Off".

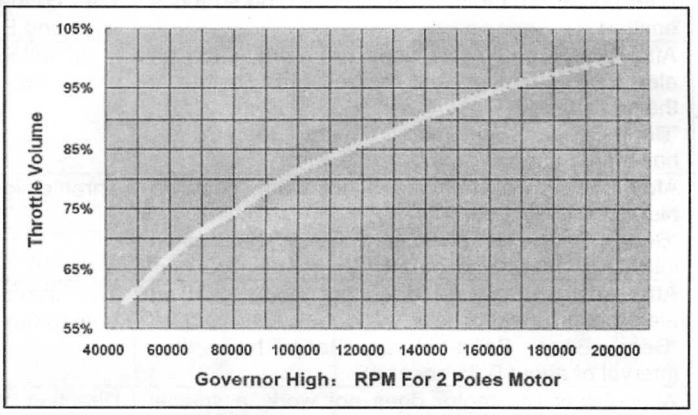
If the governor mode is activated, the ESC will try its best to hold the motor speed at a fixed value. (Usually the throttle curve is a horizontal line, you can change the preset motor speed by changing the height of this line)..

The speed range of "Governor Low" mode is 10000RPM to 45000RPM for 2 poles brushless motor, "Governor High" mode is 46000RPM to 200000RPM for 2 poles brushless motor. In order to calculate the speed of the main rotor blades of your helicopter, you need to know the motor poles number and the gear rate of main drive gear vs. the pinion. For example, if you are using a 6 poles motor (that is: 3 pair poles), and the main drive gear is 150T, the pinion is 13T, so you can calculate as follows:

The rotation speed for the main rotor blades = (The speed of 2 poles motor * 13) / 3 / 150

When you adjust the throttle curve, please make sure that the motor can run at this preset speed even if the motor load is heaviest. Please note that the governor mode function is automatically disabled if the throttle volume is less than 60%.





8. **Motor Type：** *Normal Motor / Special Motor 1 / Special Motor 2, default is "Normal Motor".

Usually, the default value "Normal Motor" is suitable for most of motors, but if the motor cannot run smoothly with this mode, please try other 2 options.

9. **PWM Frequency:** *12KHz / 24KHz, default is "12KHz".

For some motors with high KV (high speed) and many poles, the 24KHz PWM frequency may let them work more smoothly. But the higher PWM frequency will make the ESC to be hotter.

10. **Built-In BEC Output:** *5.25V / 6V, default is 5.25V.

11. **Motor Load:** Normal / Heavy / Very Heavy / Auto.

For normal voltage ESC (supports 2-6 cells Lipo), the default value is "Normal";

For high voltage ESC (supports 5-12 cells Lipo), the default value is "Auto";

When you accelerate the motor immediately, if the motor suddenly stop running and emits scream sound, please try to set this item to other value.

12. **Lipo Cells:**

For normal voltage ESC (supports 2-6 cells Lipo), the values are *Auto / 2S / 3S / 4S / 5S / 6S, the default is "Auto"; ***Note4***

For high voltage ESC (supports 5-12 cells Lipo), the values are *Auto / 5S / 6S / 8S / 10S / 12S, the default is "Auto".

This programmable item is available for lithium battery. In the startup process, the motor will emits several "Beep-" tones to represent the Lipo cells number, it is helpful for you to check whether it is coincident with the actual battery pack or not. ***Note5***

Note4: *If you choose "Auto", the ESC may mistakenly judge the battery cells when the voltage is less than 3.7V/Cell,* ***so we strongly suggest setting the "Lipo Cells" manually.***

Note5: *For high voltage ESC (supports 5 to 12 cells Lipo), when the motor emits the "Beep" tones to represents the cells number, a long "Beep—" tone = 5 short "Beep-" tone. So 5S = "Beep—", 6S = "Beep—Beep-" (1 long 1 short), 8S="Beep—Beep-Beep-Beep-" (1 long 3 short), 10S= "Beep—Beep—" (2 long), 12S="Beep—Beep—Beep-Beep-" (2 long 2 short). While for normal voltage ESC (supports 2 to 6 cells Lipo), we still use 5 short "Beep-" tones to represent 5S lipo, and 6 short "Beep-" tones to represent 6S lipo.*

【Begin To Use The New ESC 】

Please check the wiring and connections carefully, and then start the ESC in the following sequences:

1. Move the throttle stick to the bottom position and then switch on the transmitter.
2. Connect the battery pack to the ESC, the ESC begins the self-test process, a special tone "♪ 123" is emitted, which means the voltage of the battery pack is in normal range, and then N "Beep" tones will be emitted, means the number of lipo battery cells. Finally a long "Beep—" tone will be emitted, which means the self-test is OK, the aircraft or helicopter is ready to go flying.

- If nothing is happened, please check the battery pack and all the connections;
- If a special tone "♪567i̇2 " is emitted after 2 Beep tones ("Beep-Beep-"), means the ESC has entered the program mode, it is

because the throttle channel of your transmitter is reversed, please set it correctly;

- If the red LED flashes very quickly (2 times per second), means the input voltage is too low or too high, please check your battery's voltage.

3. **VERY IMPORTANT !** Because different transmitter has different throttle range, you need to calibrate the throttle range and let the ESC remember it. Please read the instruction on the left bottom of this page ------"Throttle Range Setting".
   After correctly setting the throttle range, the red LED lights when the throttle stick is moved to the top position (Maximum throttle).

【Alert Tone】

1. Input voltage is abnormal: The ESC begins to check the voltage when the battery pack is connected, if the voltage is not in the acceptable range, such an alert tone will be emitted: "Beep-Beep-, Beep-Beep-" (Every "Beep-Beep-" has a time interval of about 1 second), and at the same time, the red LED also flashes.
2. Throttle signal is lost: When the ESC can't detect the normal throttle signal, such an alert tone will be emitted: "Beep-, Beep-, Beep-". (Every "Beep-" has a time interval of about 2 seconds)
3. Throttle stick is not in the bottom position: When the throttle stick is not in the bottom (lowest) position, a very rapid alert tone will be emitted: "Beep-, Beep-, Beep-". (Every "Beep-" has a time interval of about 0.25 second.)

【Protection Function】

1. Abnormal startup protection: If the motor fails to start within 2 seconds of throttle application, the ESC will cut-off the output power. In this case, the throttle stick **MUST** be moved to the bottom position again to restart the motor. (This happens in the following cases: The connection between ESC and motor is not reliable, the propeller or the motor is blocked, the gearbox is damaged, etc.)
2. Over-heat protection: When the temperature of the ESC is over a factory-preset degree, the ESC will reduce the output power.
3. Throttle signal loss protection: The ESC will cutoff the output power if throttle signal is lost for more than 0.25 second, the output power will be resumed as soon as the throttle signal is normal again.

【Trouble Shooting】

Trouble	Possible Reason	Action
After power on, motor does not work, no sound is emitted	The connection between battery pack and ESC is not correct	Check the power connection. Replace the connector with new one
After power on, motor does not work, such an alert tone is emitted and the red LED flashes at the same time. "Beep-Beep-, Beep-Beep-" (Every "Beep-Beep-" has a time interval of about 1 second)	Input voltage is abnormal, too high or too low.	Check the voltage of battery pack
After power on, motor does not work, such an alert tone is emitted: "Beep-, Beep-, Beep- "(Every "Beep-" has a time interval of about 2 seconds)	Throttle signal is irregular or lost	Check the receiver and transmitter Check the control cable of the ESC
After power on, motor does not work, such an alert tone is emitted: "Beep-, Beep-, Beep-" (Every "Beep-" has a time interval of about 0.25 second)	The throttle stick is not in the bottom (lowest) position	Move the throttle stick to bottom position Set the throttle trimmer to neutral or even lower.
After power on, motor does not work, a special tone "♪5671̇2̇" is emitted after 2 "Beep" tones (Beep-Beep-)	Direction of the throttle channel is reversed, so the ESC has entered the program mode	Set the direction of throttle channel correctly (Please refer to the user manual of your transmitter)
The motor runs in the opposite direction	The connection between ESC and the motor need to be changed.	Swap any two wire connections between ESC and motor
The motor stop running while in working state	Throttle signal is lost	Check the receiver and transmitter Check the control cable of throttle channel
	ESC has entered Low Voltage Protection mode	Land RC model as soon as possible, and replace the battery pack
	Some connections are not reliable	Check all the connections: battery pack connection, throttle signal cable, motor connections, etc.
Random stop or restart or irregular working state	There is strong electro-magnetic interference in flying field.	Reset the ESC. If the function could not resume, you might need to move to another place to fly.

【Normal Startup Procedure】

Move the throttle stick to bottom position and then switch on your transmitter	Connect the battery pack to the ESC, a special tone "♪123" emits, that means the battery supply is OK	Several "Beep-" tones emits to represent the number of lipo battery cells	As soon as the self-test process is finished, a long "Beep—" tone will be emitted	Move the throttle stick upwards to go flying now

【Throttle Range Setting】

Switch on the transmitter, and then move the throttle stick to top position	Connect battery pack to the ESC, a special tone "♪123" emits, that means the battery supply is OK, then wait for 2 seconds	"Beep-Beep-" tone emits, that means the highest point of throttle range has been correctly confirmed	Move throttle stick to the bottom position, several "Beep-" tones emits to represent the number of Lipo battery cells	A long "Beep—" tone emits, means the lowest position of throttle range has been confirmed

【Program The ESC With The Transmitter】 (4 Setps)

1. Enter program mode
2. Select programmable items
3. Set item's value (Programmable value)
4. Exit program mode

1. Enter program mode

a) Switch on transmitter, move the throttle stick to the top position.

b) Connect the battery pack to the ESC, a special tone "♪123" emits, that means the battery supply is OK.

c) Wait for 2 seconds, the motor will emit "Beep-Beep-" tone.

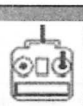
d) Wait for another 5 seconds, special tone like "♪ 56712 " emits, that means the program mode is entered

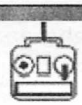
2. Select programmable items:

After entering program mode, you will hear 14 groups of "Beep" tones in a loop with the following sequence. If you move the throttle stick to bottom position within 3 seconds after one kind of tones, the corresponding item will be selected.

1	B	Brake	(1 short tone)
2	BB	Battery Type	(2 short tones)
3	BBB	Cutoff Mode	(3 short tones)
4	BBBB	Cutoff Threshold	(4 short tones)
5	Beep—	Start Mode	(1 long tone)
6	Beep—B	Timing	(1 long 1 short)
7	Beep—BB	Governor Mode	(1 long 2 short)
8	Beep—BBB	Motor Type	(1 long 3 short)
9	Beep—BBBB	PWM Frequency	(1 long 4 short)
10	Beep—Beep—	Built-in BEC Output	(2 long tones)
11	Beep—Beep—B	Motor Load	(2 long 1 short)
12	Beep—Beep—BB	Lipo Cells	(2 long 2 short)
13	Beep—Beep—Beep—B	Reset All To Defaults	(3 long 1 short)
14	Beep—Beep—Beep—BB	Exit	(3 long 2 short)

Note: *"Beep—" means a long "Beep" tone, "B" means a short "Beep" tone. Usually, 1 long "Beep—" = 5 short "B".*





3. Set item value (Programmable value):

You will hear several "Beep" tones in loop. Set the value matching to a tone by moving the throttle stick to top position when you hear the tone, then a special tone "♪1515" emits, that means the value is set and saved. (Keep the throttle stick at the top position, you will go back to Step #2 and you can select other items; Or Move the stick to bottom position within 2 seconds will exit program mode directly)

Beep / Items	1 short	2 short	3 short	4 short	1 long	1 long 1 short	1 long 2 short	1 long 3 short
Brake	***Off**	Soft	Hard	Very Hard				
Battery Type	***LiPo**	NiMH						
Cutoff Mode	***Soft Cut**	Hard Cut						
Cutoff Threshold	Low	***Middle**	High	Custom				
Start Mode	***Normal**	Soft	Very Soft					
Timing	0°	3.75°	7.5°	11.25°	***15°**	18.75°	22.5°	26.25°
Governor Mode	*Off	Governor Low	Governor High					
Motor Type	***Normal Motor**	Special Motor 1	Special Motor 2					
PWM Frequency	***12KHz**	24KHz						
Built-in BEC Output	***5.25V**	6V						
Motor Load	***Normal**	Heavy	Very Heavy	Auto			← For normal ESC (2 to 6S Lipo)	
	Normal	*Heavy*	*Very Heavy*	***Auto**			← For high voltage ESC (5 to 12S Lipo)	
Lipo Cells	***Auto**	2S	3S	4S	5S	6S	← For normal ESC (2 to 6S Lipo)	
	***Auto**	*5S*	*6S*	*8S*	*10S*	*12S*	← For high voltage ESC (5 to 12S Lipo)	

The value with * symbol is the factory-preset value (That is: default value).

4. Exit program mode

There are 2 ways to exit the program mode:

a) In Step #3, after special tone "♪1515", please move the throttle stick to the bottom position within 2 seconds.

b) In Step #2, after tone Beep—Beep—Beep —BB" (3 long 2 short Beep tones, that is the item #14), move the throttle stick to the bottom position within 3 seconds.